

## XII. NOTES ON THE NEUROPTERA IN THE COLLECTION OF THE INDIAN MUSEUM.

By JAMES G. NEEDHAM.

The observations of the following pages are based on the study of a large series of miscellaneous Neuroptera belonging to the Indian Museum, sent to me by the Superintendent, Dr. Annandale, for study. With these were sent a considerable number of specimens from the collection of the Imperial Entomologist, Mr. Maxwell-Lefroy. Together, these specimens illustrate the greater part of the described Neuropterous fauna of the Indian empire. The entire known fauna in the Mantispidæ was represented: the smallest proportion of it was present in the Odonata.<sup>1</sup> This latter group has been collected a little more systematically perhaps than any other, but the specimens reside mainly in the collections of the European specialists who have described them, or in the British Museum.

Of the true Neuroptera (*Neuroptera s. str.*) most of the Indian forms have been described by three British naturalists: by Francis Walker, in the *Catalogue of Neuropterous Insects of the British Museum*, and in vol. v of the *Transactions of the Entomological Society of London*; by J. O. Westwood in his *Cabinet of Oriental Entomology*; and by Robert McLachlan in various scattered papers. Nearly all of Westwood's species are in the collection, including his *Ascalaphus obscurus*, a species long considered lost.

The Perlidæ of the collection are mostly new to science, which is not surprising, since but one species was known from the whole of India. The Odonata, Ephemeridæ, and Myrmeleonidæ of the collection are mostly well known, and in the Hemerobiidæ, Chrysopidæ, Ascalaphidæ, and Perlidæ occur the most interesting new forms and all the new genera.

In the collection were a few Termites which, for want of any knowledge of the group, I was compelled to return unnamed. And likewise, not knowing the Trichoptera, with Dr. Annandale's consent, I turned them over to Dr. C. Betten for study, and his report on them follows further on (p. 231). I have to express my gratitude to Dr. Annandale for his patience in waiting through the

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<sup>1</sup> By far the greater part of the collection of the Indian Museum was named some years ago by the late Baron de Sélys Longchamps, and therefore was not sent to Prof. Needham.—*N. Annandale*.

delays of sickness and change of location for the return of the specimens, and for this report upon them.

### PERLIDÆ.

This is the most neglected of all the neuropteroid groups of the Indian fauna. Hitherto, apparently, there has been but one species of stone-fly described from the whole of India, and that one very imperfectly. It is the *Perla duvaucelii* of Pictet, known hitherto from a single specimen in the Museum of Paris. It is represented in the present collection by two male specimens, and with it are six other undescribed species. One of these is represented by a mere fragment: the other five are described herewith. Three are referred to *Perla* (s. lat.), one each to *Neoperla* and *Leuctra*, and one represents a new and very interesting genus with hairy eyes and greatly reduced labial palpi.

#### *Perla benigna*, sp. nov.

One male. Sikhim, E. Himalayas (Reg. No.  $\frac{5994}{7}$ ).

Length 12 mm., with setæ 5 mm. or more additional, the tips perhaps broken. Expanse of wings 30 mm.

A brownish species with conspicuous yellow costal border to the fore wings. Head wider than the prothorax, and closely inserted into its flaring front end. Prothorax wider anteriorly, with rather straight fore border and sharp angles: hind angles more or less obtuse. Head blackish above, with an open W-mark directed backwards between the antennæ, the middle point of the W resting on the middle ocellus. Tubercles of the vertex yellow. Antennæ brown, the sides of the basal segment darker.

Prothoracic disc minutely pubescent, scarcely rugulose, fuscous in colour with a yellowish median line that is dilated anteriorly and runs out narrowly along the front border. Meso- and meta-thorax brown above and below and paler across the ends and along the sides. Abdomen yellowish, the three apical segments slightly darker. Legs yellow at the base, including two-thirds of the femora; beyond this brown. Setæ fuscous, concolourous, with dense pubescence and numerous stouter hairs; 15 segments present, measuring 5 mm., wings (pl. xix, fig. 1) brown, with a yellow costal band that is delimited behind by the main stem of the radial vein, except towards the base where it is a little wider; the veins in the yellow band are very indistinct. The venation is shown in plate xix, fig. 1.

The ninth segment of the abdomen (pl. xix, fig. 3) of the male is narrow upon the dorsal side and very wide below. On the mid-dorsal line (pl. xix, fig. 2) it is produced backward in a thin, flat, bifid triangular process. On the ventral side it is prolonged greatly, and upturned to enclose the tip of the abdomen. The upturned end is squarely truncated and margined with a rim-like

carina, beneath which is a conspicuous round callosity or tubercle, directed posteriorly. On the sloping sides of the apical margin of the ninth segment is another low carina which is decurrent at its junction with the posterior rim just described. The tenth segment is narrow and is mostly included. A pair of hooks arise from the inner side of the setæ, curving dorsally and then forward, with their tips opposed to the bifid dorsal process of the ninth segment (pl. xix, figs. 2, 3 and 4).

This is the largest species in the collection, and it is doubtless in life a rather handsome insect. It combines characters of the American genus *Acroneuria* with those of *Perla*, and will doubtless eventually be removed to a new genus.

*Perla ione*, sp. nov.

Eight males and five females. Kulu, W. Himalayas (Reg. Nos.  $\frac{5838}{5}$ ,  $\frac{6938}{1}$ ,  $\frac{5831}{5}$ ,  $\frac{5830}{5}$ ), also one of more recent collection by Dr. Annandale from Kurseong, probably of the same species, although the sides of the prothorax appear to be more convergent behind and the spot on the top of the head is more extensive. A specimen labelled Kurseong, E. Himalayas (Reg. No.  $\frac{1556}{14}$ ), also appears to be the same.

An obscure brownish species, with scanty and indistinct markings. Length of male 11 to 15 mm., antennæ 8 mm. and setæ 5 to 6 mm. additional, and expanse of wings 33—35 mm. Length of female 15 mm. and expanse of wings 43—45 mm.

Head yellowish, with a diffuse fuscous spot between the ocelli (in the unnumbered specimen mentioned above, overspreading the ocelli in an obscure quadrate path). Antennæ fuscous. Body nearly uniform brownish. Legs yellowish brown, somewhat darker on the knees and tarsi. Wings subhyaline, with veins obscurely fuscous. Setæ yellowish.

The ninth abdominal segment is extended beneath posteriorly in a long scoop-shaped prolongation, which covers only the lower third of the end of the abdomen. Externally it is regularly convex and smooth without callosity, but with a more or less thickened rim across the upturned margin. The tenth segment is included below, but exposed and bifid above, divided into two high prominences, that are at first erect and then suddenly bent forward, ending in obtuse points, parallel and closely approximated (pl. xix, fig. 5). The eighth ventral abdominal segment in the female is prolonged posteriorly on the ventral side in an obtusely triangular flap nearly as wide as the abdomen.

This is the most abundantly represented species in the collection, and it is a typical *Perla*.

The eggs of this species as they appear when removed from the ovary are roundish oval with a revolute strongly chitinated collar at the micropylar end: the margins of the collar are lobed and fimbriate (pl. xix, figs. 6 and 7). The surface of the shell is pitted all over with little round shallow depressions.

*Perla cymbele*, sp. nov.

A single female specimen from Pharping, Nepal, altitude *circa* 5,000 feet (R. Hodgart, October 1907).

Very similar to the preceding species; a little smaller. Length 12 mm. Expanse of wings 32 mm.

Brown. Head pale brownish, with a broad diffuse transverse band of darker brown between the eyes and covering the ocelli. Ocelli equidistant from each other and from the eyes, the anterior ocellus one-half smaller than the others. The elevated antero-lateral margins of the frons have a blackish tinge.

The prothorax is wider than the head. Its fore border is straight or slightly bisinuate, the anterior angles are slightly acute, the sides are slightly convex and convergent posteriorly to the slightly obtuse hind angles. There is a fine black transverse carina on the disc closely paralleling the front margin, joined in the rear by a similar mid-dorsal narrow black line. On the sides of the disc are some low obscure rugosities. The meso- and metathorax and the basal segments of the abdomen are yellowish brown. Legs yellowish brown, slightly darker on the tarsi. Wings smoky hyaline. Antennæ and setæ broken.

The posterior ventral prolongation of the eighth abdominal segment is slightly narrower than in *P. ione*, and distinctly bifid at the tip. It is thin and transparent, and not easy to see in dried specimens.

The eggs of this species are very different from those of *P. ione*, being elongate oval, or slightly narrowed to the micropylar end. They are deeply pitted all over the opposite end. The chitinated rim about the micropyle is low and smooth, and not revolute.

*Neoperla indica*, sp. nov.

Three males and five females. Kulu, W. Himalayas (Reg Nos.  $\frac{6925}{1}$ ,  $\frac{6930}{1}$ ,  $\frac{6936}{1}$ ). A yellowish species near *Perla luteola*, Burm., and *Neoperla pilosella*, Klp., from Java. Length of male about 7 mm., expanse of wings 21 mm. Length of female about 10 mm., expanse 28 mm.

Colour brownish yellow, darker above on the head and prothorax, paler beneath and on all the appendages. Antennæ long, somewhat paler towards the base, and clothed throughout with close pubescence, as are the long yellow palpi. Head without distinguishable colour pattern, with a diffuse darker area on the disc and darker pigmentation around eyes and ocelli. Each of the two ocelli is separated from the other by about its own diameter.

Prothorax straight margined in front, slightly narrowed on the convex sides posteriorly in the male, but not perceptibly narrowed in the female, its disc sub-rugulose, and with a fine brown mid-dorsal line, and a similar line on each lateral margin. Legs yellow: only the claws brownish. Wings (pl. xx, fig. 1) yellowish, veins darker. Setæ and abdomen yellow, the former clothed with short pubescence.



The seventh abdominal segment of the male bears a mid-dorsal backwardly directed conical prominence with roughened tip, and the eighth segment bears a somewhat similar process that is, however, ante-apical, thin and flat and squarely truncated on the tip (pl. xx, fig. 2). The ninth segment is moderately produced on the lower side and upturned so as to cover a little of the apex of the abdomen, and bears on its dorsal side a pair of roughened prominences, between which rest the tips of the longer prominences of the divided tenth segment. These latter are long-conic, directed forwards and convergent at tips.

The eighth segment of the female is apparently scarcely produced posteriorly on the ventral side, but straight margined, the thin edge of the sternite that covers the openings of the oviducts being very difficult to see.

*Perla duvauceli*, Pictet.

*Hist. Nat. Névr., Perlides*, pp. 258-9, pl. xxvii, figs. 1-2, 1841

Two males in the collection of the Museum from Kulu (Reg. Nos.  $\frac{58+6-47}{5}$ ). These specimens were pinned, and old, and badly shrivelled, but when boiled in KHO the essential characters became readily apparent. Both agree in size with Pictet's brief description, and one of them showed enough of colour pattern for comparison.

Length about 11 mm., with antennæ 5 mm. and setæ 3 mm. additional. Expanse of wings 25 mm. There are two minute ocelli wide apart upon the disc of the head: the antennæ and setæ are yellow, and pubescent, with hairs of the same tawny colour. The prothorax is narrower than the head, and is transversely oval in form, with all the angles rounded off, the hind angles a little more broadly rounded. The wings are yellowish, with weak venation, especially indistinct along the costal margin (pl. xix, fig. 11).

The ninth abdominal segment of the male (pl. xix, figs. 12-14) is very peculiar. Its posterior prolongation on the ventral side is short, not upturned around the end of the abdomen, and before it on the middle of the segment is a low, broad, hairy elevation bearing a membranous penis at its tip. The tenth segment is annular and exposed, one-third as long as the ninth; from its hind margin on the dorsal side there grows out posteriorly a short stout downwardly directed spine. To this spine are opposed two claw-like upcurved hooks that arise from the inner side of the base of the setæ.

I confess to much pleasure in identifying this species, which has stood for more than half a century as the only representative of this family known from India. It is destined ultimately to bear another generic name.

CRYPTOPERLA, gen. nov.

Eyes hairy; labial palpi greatly reduced; face vertical with high frontal ridge; venation as shown in pl. xix, fig. 15. Otherwise much like *Neoperla*.

Type, the following species:—

*Cryptoperla torva*, sp. nov.

(Pl. xix, figs. 15—21.)

A single female specimen from Kulu, W. Himalayas (Reg. No.  $\frac{5848}{6}$ ).

Length 9 mm., and antennæ 7 mm. additional; setæ wanting.

Colour nearly uniform pale yellowish brown, a little paler beneath and on the setæ and bases of legs. Head very flat above, its disc margined anteriorly by an irregularly semicircular elevated margin, which overhangs the base of the antennæ, and beneath which the face is vertical. Ocelli apparently two but very obscure. Antenna with the obliquely conic second segment set at an angle upon the stout basal segment; there appears considerable irregularity in the slenderer segments immediately following; there are forty or more segments in all. Maxilla with palpus of normal length, but the labium with greatly abbreviated palpi having the terminal segment conically pointed (pl. xix, fig. 21).

The wings are subhyaline, slightly darker on the costal margin, especially in the stigmatic region: the venation is shown in pl. xix, fig. 15.

The eighth segment of the female is remarkably produced on its ventral side in an enormous scoop-shaped concave plate, widely truncated across the end, and covering the entire tip of the abdomen ventrally. Its lateral margins spring from the middle of the sides of segment 9 (pl. xix, fig. 1a).

*Leuctra indica*, sp. nov.

Three specimens from Upper Assam (Reg. Nos.  $\frac{1321}{9}$ ,  $\frac{1351}{9}$ ,  $\frac{1348}{9}$ ).

Length of body 4 to 5 mm. and antennæ of equal length; expanse of wings of male 11 to 12 mm.

Colour brown, the legs, the under side of the body, the base of the antennæ and the middle of the abdomen, paler. Wings fumose with brown veins. Venation shown in figure 3 of pl. xx. The end segments of the abdomen are of a darker brown. The male appendages are shown in dorsal and lateral views in figures 4 and 5 of plate xx.

## ODONATA.

The collection in this order consists almost entirely of well known representatives of the Indian fauna, and a list of it would add little to present knowledge. A single *Gomphidia T-nigrum* in the Lefroy collection is the only Gomphine in the lot. Apart from some of the smaller Agrioninæ, which I may take occasion to report on later, the most interesting specimens of the order were three species collected rather recently by Dr. Annandale. Two of these were from Bhim Tal, Kumaon; a fine pair of *Anotogaster basalis*,

Sél., and several of both sexes of the elegant *Megalestes major*, Sél., both collected on the 22nd of September 1906. The other one of the three is *Bayadera hyalina*, Sélys, represented by both sexes, from Kurseong, E. Himalayas, 5,000 ft.

### EPHEMERIDÆ.

The mayflies of the collection were, as is always the case with pinned specimens, in rather dilapidated condition, and not all are determinable. There appear to be about nine species, as follows:—

*Palingenia* sp.? perhaps *P. robusta*, Etn.—In absence of figures of the male genitalia, I am unable to be sure about the identity of these specimens; all are in bad condition, more or less teneral, and with crumpled wings. The species will be recognized by the male forceps figured herewith (pl. xx, fig. 8), which is different from the forceps of any species that has been figured hitherto. It belongs to the subgenus *Anagenesia*. (The specimens are from Seistan, Persia —*N. A.*)

There are three nymphs of some species of *Palingenia* collected by Dr. Annandale at Matiana, Simla hills, and sent to me in alcohol.

*Ephemerella* sp.—A series of specimens in the Lefroy collection from Pusa, Bengal, that at present I do not feel qualified to name; the forceps limb of the male is shown in pl. xx, fig. 9.

The genus *Epeorus* is represented by a fragment of a female sub-imago without locality label.

*Chlæon marginata*, Hagen.—This species and the following one, hitherto known only from Ceylon, are represented in the collection by a series of both pinned and alcoholic specimens. The specimens are from Calcutta, and from Rajshahi, E. Bengal, in February and December; from Sylhet in November and December; sub-imagos and cast sub-imaginal skins are included in the alcoholic material from Rajshahi, where the skins “were found on the walls of a room of a house some distance from water.”

*Chlæon bimaculatum*, Etn.—This species was found with the preceding by Dr. Annandale at Rajshahi, E. Bengal. The wings of the male are quite hyaline, and therefore I think it is a female that is meant where male is stated in Eaton's *Monographic Revision of Ephemeridæ*; with that adjustment the agreement of these specimens with those described from Ceylon (p. 182), save for an unnoticed brown spot before the apex of the hind femur, appears to be complete. I figure on pl. xx, fig. 6, the wing of the female, and on pl. xx, fig. 10, the forceps limb of the male.

There are three small nymphs in alcohol which might belong, so far as I can see, to either one of the two preceding species.

*Cænis perpusilla*, Walk.—Specimens, both pinned and alcoholic from Rajshahi, appear to agree with this insufficiently known species, which was described from Ceylon. It may be

further described from material carefully preserved by Dr. Annandale, as follows:—

Length of male 3.5 mm., with setæ 11 mm. additional. Length of female about 4 mm., with setæ 3.5 to 4 mm. additional. Expanse of wings 9 mm.

White, with narrow lines of sooty black across the top of the head between the eyes, and on the sides of the prothorax, and on the humeri of the mesothorax and across the apex of the metathorax, and across the apical dorsal margins of the abdominal segments. The black is a little more pronounced towards the sides of the segments and towards the apex of the abdomen. Mesothorax pale brown above with a narrow paler median line. Wings whitish, with the usual purplish costal band, whose extent is indicated in pl. xx, fig. 7.

The nymphs of two additional species, also collected by Dr. Annandale, at Matiana, Simla district, W. Himalayas (8,000 ft.), are worthy of mention, since they are all that are known of two species representing other genera in India. The first of these is a single grown nymph (length 8 mm.) of a species of *Leptophlebia*, a genus hitherto unreported from India. The coloration is dark olivaceous above and yellowish below (perhaps greenish in life). The setæ are broken off. The side margins of the abdominal segments are narrowly yellow above, and there is a pair of small oblique submedian dots on the dorsum of each segment.

There are also two nymphs, of a species of *Heptagenia* (s. lat.), from a small stream at Matiana, which differ from all known nymphs of that genus in the possession of a series of mid-dorsal abdominal hooks or triangular teeth, one terminating the mid-dorsal keel on each segment from the first to the ninth, successively smaller on the eighth and ninth segments. These are pale smooth nymphs, the larger of which measures 12 mm. in length of body. There is a conspicuous black spot on the humeral cross-vein in the nymphal wing which may be carried over in the adult.

#### PSOCIDÆ.

This family is represented in the collections before me by half a dozen species, three of which are well known, one of which is undeterminable, and the other two of which are new. Unfortunately, while the well-known species are represented by excellent series of specimens, the new ones are not, and are therefore left unnamed.

*Psocus taprobenes*, Hagen.—The Museum specimens of this handsome species are from Calcutta, Munshibazar (S. Sylhet) and Upper Assam, and those in the Lefroy collection are from Rungpore (Eastern Bengal and Assam), from Dacca, and from Pusa, Bengal.

*Ceratipsocus subcostalis*, Enderlein, is represented by a single specimen in the Museum collection from Upper Assam.

*Myopsocus griseipennis*, McL.—About a dozen specimens collected by Dr. Annandale at Bhim Tal, Kumaon (alt. 4,500 ft.), W. Himalayas, in September 1906.



*Myopsocus* sp. A.—A species very similar to the preceding, with an expanse of wing of 13 mm. and in coloration much less densely marmorate on the wings; stigma yellow, and basal cells of the wing and a space before the cubital vein more or less hyaline. Specimens from Upper Assam.

*Ceratipsocus* sp. B.—This is a smaller species (expanse of wings 8 mm.) with wings clouded rather than marmorate, and with an equal distribution of the clouds all over them: veins alternately white and black. Specimens from Upper Assam.

*Epipsocus* sp. (?).—Specimens in the Lefroy collection from Pusa, Bengal.

#### EMBIIDÆ.

I have spent much time over the three or four species of this family represented in the collection, with not very satisfactory results. I think I have identified *E. saundersi*, Westwood (from Surat, Bombay Presidency, "at light"; Pusa collection), and *E. michaeli*,<sup>1</sup> McLachlan, but what the third species that is represented by a single male specimen from Pamben, Rameswaram Island, Palk Straits, S. India, is, and whether described or not, I am unable to say. It is hard to pick out distinctive characters from bare descriptions. But my figures of the male abdominal appendages on pl xx, figs. 11—13, will enable anyone who comes after me to be certain as to what species I had before me. The third species, near *E. tartara*, Saussure, but with complete venation, 24-jointed antennæ, and an expanse of 17 mm., is perhaps the same as the large black wingless females in the Lefroy collection.

#### SIALIDÆ.

##### *Corydalis territans*, sp. nov.

One female from Sikkim, E. Himalayas (Reg. No.  $\frac{8826}{3}$ ).

Length of body 40 mm. (probably considerably more in life for the abdomen is shrunken). Expanse of wings 136 mm. Head entirely rufous. Mandibles black. Antennæ broken, only two basal segments present; these are rufous at ends and broadly ringed with jet black between. The elevated rim of the vertex at the inner side of the antennæ is edged with black, as are the three close-set ocelli internally. Disc of the head rugulose, without colour pattern. The lateral margins of the hind angles of the head are thin and flat and minutely serrulate on their flaring border, produced behind into the usual sharp spine, and in this species ending anteriorly in a second thin flat triangular spine or tooth just behind the eye, while the tooth which in other Oriental species of this genus lies nearer the top of the head, is in this species wanting.

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<sup>1</sup> Males of this species are often found in Calcutta at night on whitewashed walls illuminated by lamps, both outside and in houses.—N. A.

Prothorax slightly longer than wide (length 7 mm., width 6 mm.), red and finely transversely rugulose above, with a long black lateral stripe each side, more or less tending to be broken into three spots. Second and third thoracic segments and abdomen of a sordid reddish fulvous.

Wings fumose, with partly hyaline cells between the brown-bordered costal cross-veins and with two conspicuous hyaline bars across the disc, bordered by areas of darker brown. These hyaline bars cross the area traversed by the radial, median and cubital veins; the proximal bar is at the level of the base of the radial sector and the second at the level of the first fork of the sector. On the proximal side of the first bar three basal cells are more or less hyaline, and on the distal side of the second bar are four small hyaline spots in the next adjacent cells, the two anterior quadrate, the two posterior smaller, linear, the three posterior, in line, and out of line with the first.

Hind wing without hyaline spots, with veins of darker brown all around the wing-margin.

Legs rufous beneath and basally, blackish superiorly and towards the apex. The fore femora are darker than the others.

The three Oriental species now made known in the genus, which was so long supposed to be strictly American, may be separated as follows:—

- a. Two teeth on the lateral margin of the head, and none on the convex surface above the hind angle: head red .. *territans*, Ndm.
- aa. One tooth on the lateral margin at the hind angle of the head on each side, and one above this on the convex surface. Head bicoloured.
- b. The darkest markings of the fore wings comprised in a wide costal strip .. .. *asiatica*, Hardwicke, W. China.
- bb. Darkest markings of the fore wings are upon the cross-veins of the wing disc .. *orientalis*, McL., Naga Hills, Assam.

There remains also a fourth species, mentioned by McLachlan in the *Transactions of the Entomological Society of London* for 1896, p. 283, but not described, from Assam, which agrees with *asiatica* and *orientalis* in the conformation of the hind angles of the head, and not at all with *territans*. Probably good specimens of this species will yet be found.

Of other Sialidæ, the collection includes four species of *Neuromus* and one of *Chauliodes*:—*Neuromus latratus* from Shillong, Khasi Hills, Assam; *N. infectus*, McL., from Sikkim; *N. decemmaculatus*,

Wlk., from the N. Khasi Hills (*Godwin-Austen*); and *N. maculipennis*, Gray, from the same locality. The *Chauliodes* is *Ch. simplex*, Walker, likewise from the N. Khasi Hills (*Godwin-Austen*).

### MANTISPIDÆ.

All the members of this family that have hitherto been reported from India are represented in the Museum collection.

*Mantispa nodosa*, Westwood.—There is a single broken specimen of this huge species from the Domdami Valley, N. Assam (Reg. No.  $\frac{9797}{152}$ ).

*Mantispa rugicollis*, Navas.—Of this species, recently described from the Himalayas, there is a single good specimen from Sikkim (Reg. No.  $\frac{9798}{158}$ ). Another wingless fragment, apparently similar, is from Upper Assam (Reg. No.  $\frac{1265}{9}$ ).

*Mantispa quadrituberculata*, Westwood.—There is a series of this handsome species from Kulu, W. Himalayas (Reg. Nos.  $\frac{6921}{1}$ ,  $\frac{6923}{1}$ ,  $\frac{6924}{1}$ ), and Sibsagar, Assam (*S. E. Peal*).

*Mantispa lineolata*, Westwood.—From Kulu, W. Himalayas (Reg. Nos.  $\frac{6916}{1}$ ,  $\frac{6917}{1}$ ,  $\frac{6919}{1}$ ).

*Mantispa indica*, Westwood.—Kangra Valley, W. Himalayas, 4,500 ft., November 1899 (*Dudgeon*); Sikkim; Upper Assam; Calcutta (Reg. No.  $\frac{9799}{159}$ ).

### PANORPIDÆ.

Four species representing this family are in the collection before me, two that have long been known, and two that are new to science.

*Panorpa furcata*, Hardwicke.—Soondrijal, Nepal (*Hodgart*, October, 1907) (Reg. No.  $\frac{9795}{155}$ ), three females. There is also a single pale specimen that shows hardly more of coloration on the wings than the furcate middle band; I think it is a teneral specimen of the same species.

*Panorpa appendiculata*, Westwood.—This species is represented by four females in the Lefroy collection, from Igatpuri, Bombay.

*Panorpa fenestrata*, sp. nov.

(Pl. xxi, figs. 13—15.)

Upper Assam (Reg. Nos.  $\frac{1273}{9}$ ,  $\frac{1274}{9}$ ,  $\frac{2094}{10}$ ).

Length of body 15 mm. Antennæ 11 mm. Rostrum 4 mm. Expanse of wings 28 mm.

Colour black, paler beneath and rufescent on the basal segment of the antennæ, on the hind angles of all the thoracic segments and on the sides of the rostrum. The last three abdominal segments of the male, wholly rufous.

Wings bicoloured, the basal half mainly hyaline, with two diffuse basal spots on the fore wings only, and just before the

middle with a broad transverse bar, broadly bifurcated in front, the arms of the fork surrounding a round hyaline spot on the costa. Apical half of the wings brown, inclosing a large transverse oval hyaline spot behind the stigma, and a smaller more proximal spot on the hind margin. The subcostal vein is confluent with the costal far before the stigma, and the upper division of the radial sector is three times forked. The abdominal appendages of the male are as shown in pl. xxi, figs. 13—15.

*Panorpa sordida*, sp. nov.

(Pl. xxi, figs. 16, 17.)

One male and two females, 64, 65 and 66, Pusa collection, from Khasi Hills, Assam (May). *c.* 5,000 ft., in wooded spots.

A pale brownish species with smoky hyaline, nearly concolorous wings.

Length, male 11 mm., female 10 mm. Antennæ of female 10 mm. Expanse of wings 22 mm.

Pale fuscous, the second and third thoracic segments fulvous, diffusely phalerate with blackish on all sutures. Base of antennæ tawny yellow. Legs of the same colour, the tips of the femora, tibiæ and tarsi brownish. Terminal segments of the abdomen in the male, tawny.

Wings smoky hyaline with brown veins, unmarked in the male and in one female, in the other female showing two brownish bands; the first a diffuse cross-band just beyond the middle of the wing, bifurcated and obsolescent behind, and an oblique apical spot beyond the stigma extending but little upon the hind margin beyond the apex. The sub-costal vein joins the costa at the level of the stigma, and the anterior division of the radial sector is twice forked. The abdominal appendages of the male are as shown in pl. xxi, figs. 16, 17.

#### NEMOPTERIDÆ.

*Croce filipennis*, West.—Specimens from Calcutta and from Katihar, Purneah District (*C. A. Paiva*); and in the Lefroy collection from Surat and Igatpuri, Bombay. [Common in Lower Bengal in March and April.—*N. A.*]

*Croce capillaris*, Klug.—Bushire, Persian Gulf (*W. D. Cumming*). One specimen.

*Halter halterata*, Forsk.—A series of specimens from N. Baluchistan (*Dr. Maynard*).

#### ASCALAPHIDÆ.

In the collections before me are all the Indian genera of this family save only *Ascalaphodes*, and also two new genera, described below. One of these is founded on the long-lost *Ascalaphus obscurus* of Westwood, while the other is represented by a new species.



*HOLOPHTHALMI.*

*Idricerus decrepitus*, Walk.—Two specimens, Dehra Dun, base of W. Himalayas, United Provinces, and the N.-E. Frontier of India (*Godwin-Austen*).

*ABRONIUS*, gen. nov.

Eyes undivided, body hairy, wings widest just before the middle, the front wings broader than the hind, and with a basal tooth that is penetrated by a branching vein: the area included in the cubital fork is wider than the area that lies in front of the cubital vein. The oblique vein that indicates the base of the hinder branch of the median vein is in the fore wing situated just before the base of the radial sector and just beyond the cubital fork. The

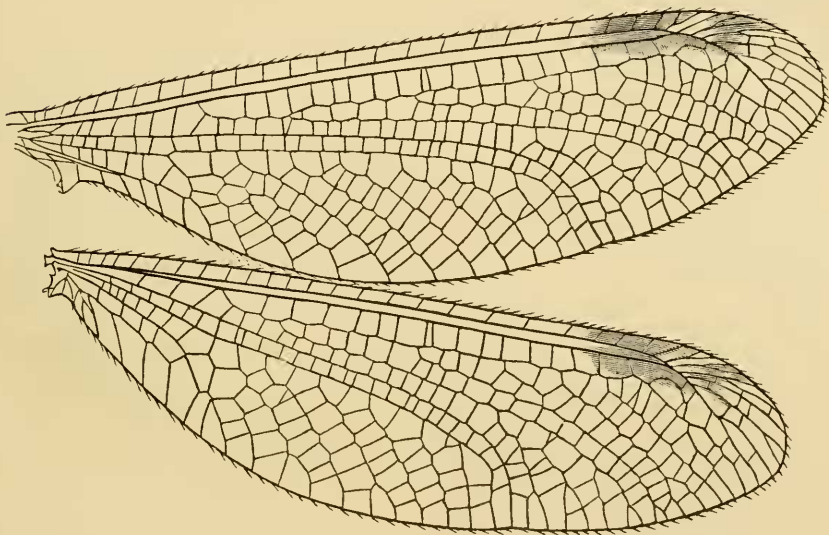


FIG. 1.—Wings of *Abroniuss canescens*, Ndm.

tibial spurs are as long as the three basal segments of the tarsus, the four basal segments are subequal and together hardly as long as the fifth, or as long as the claws.

Type, the following species:—

*Abroniuss canescens*, sp. nov.

A single incomplete specimen in the Indian Museum collection from Quetta, Baluchistan (*Webb-Ware*) (Reg. No.  $\frac{2327}{4}$ ).

Expanse of wings 54 mm. A pale greyish and tawny species with hoary vestiture. Face yellow, clothed with brown-tipped hairs, and with a tuft of longer whitish hairs arising between the bases of the antennæ. Behind the head several erect fringes of stiff hairs arise in transverse lines from the front of the thorax. Wings

hyaline with brown cross-veins, stigma yellow, diffuse, but conspicuous. Fore and hind wings of nearly equal length, but the hind wing somewhat narrower. In the cubito-anal loop of the fore wings there is but one cross-vein beyond the level of the cubital fork. Legs yellow, with hoary hairs intermixed with slender black spines. Abdomen wanting.

I judge from the description that the (?) *Idricerus albardanus* of McLachlan from Mesopotamia, belongs also to this genus.

### SCHIZOPHTHALMI.

*Ogcogaster segmentator*, West.—Seven specimens, males and females, in the Museum collection from Kulu, W. Himalayas (Reg. Nos.  $\frac{6807}{1}$ ,  $\frac{6880}{1}$ ,  $\frac{6881}{1}$ ,  $\frac{6886}{1}$ ,  $\frac{6887}{1}$ ,  $\frac{6889}{1}$ ,  $\frac{6911}{1}$ ), and one from Mundi, W. Himalayas (Reg. No.  $\frac{9635}{2}$ ).

*Ogcogaster tessellatus*, West.—One specimen in the Lefroy collection from Rawalpindi, Punjab, and one from Sirsiah, Bengal.

*Acheron longus*, Walk.—A number of specimens, mostly females, from Upper Assam; Sibsagar, Assam (male); Arrakan and Tavoy, Burma. [Also two specimens from Buxa, Bhutan frontier, E. Bengal, determined by de Sélys.—*N. A.*]

*Hybris angulatus*, West.—Several specimens (I cannot be quite sure about the females, which are still best determined by association with their males) from Johore, Malay Peninsula (*J. Wood-Mason*); Tavoy, Lower Burma (Reg. No.  $\frac{8189}{7}$ ); Sibsagar, Assam (*S. E. Peal*); and Calcutta.

*Hybris javanus*, Burm.—Two males, both broken specimens, from Karachi, W. India (*Cumming*).

*Glyptobasis dentifer*, West.—One male, Dehra Dun, base of W. Himalayas, October 14th (Reg. No.  $\frac{8013}{14}$ ).

*Siphlocerus nimius*, Walk.—One broken female specimen from Pusa, Bengal (*Lefroy collection*).

*Helicomitus* sp.?—A number of specimens, all females and therefore undeterminable (with our present knowledge of this genus), from Barsoë, Purneah District, N. Bengal, and from Calcutta, in the Museum collection; and from Pusa and Mohanpore, Bengal, in the Lefroy collection.

### STYLONOTUS, gen. nov.

Superior and inferior divisions of the eyes subequal. Club of antennæ short, obconic. Wings narrow, with their front and hind margins parallel for most of their length, fore wings much longer than the hind, meshwork open. Hind angle of the fore wing without tooth or conspicuous angulation, the radial sector five or six times forked, the median vein apparently simple, there being no oblique vein to indicate the base of a posterior branch; stigma conspicuous. The third segment of the abdomen bears a conspicuous dorsal process, longer than the segment.

Type, *S. Ascalaphus obscurus*, West.

*Stylonotus obscurus*, Westw.

McLachlan refers to this (*Trans. Ent. Soc. London* for 1891, p. 513) as a lost species. It is represented in the collection before me by one male and four female specimens. Evidently Westwood knew only the female, for he could not have missed describing the extraordinary process that arises from the back of the male abdomen. The females agree well with his description, not all of them, however, showing clearly the velvety black lines on sides of the basal abdominal segments; but some of them show these lines finely. The male may be described as follows:—

Length 26 mm. Antennæ 16 mm. Expanse of wings 55 mm. Length of fore wing 23 mm., of hind wing 19 mm. Brownish.

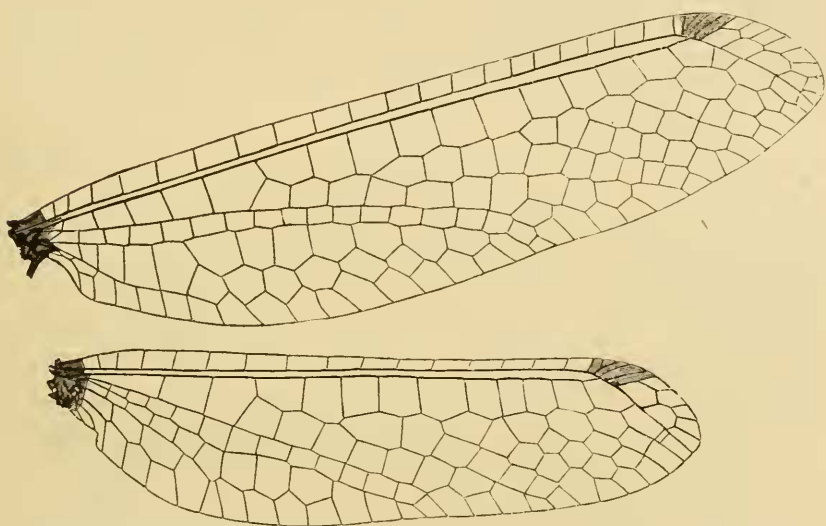


FIG. 2.—Wings of *Stylonotus obscurus*, Westw.

more or less hairy about the face, the sides of the thorax and the base and apex of the abdomen a vertical line of shining yellowish brown on the cheeks next the eyes; vertex tipped with long erect yellowish hairs. Rear of head smooth, shining, black on its lower half, yellow on the upper, with a transverse black line each side traversing the yellow area. Legs yellowish. Wings hyaline with clear reddish-brown veins and a reddish stigma that covers about four cells. Abdomen brown, paler at base, where encircled with long whitish hairs; the third segment bears a long apical stylus twice as long as the segment, clothed beneath its obtuse tip with short dense black pubescence. Terminal abdominal appendages short and concealed by the apical hairs. The single male specimen is from Kulu, W. Himalayas (Reg. No.  $\frac{6884}{1}$ ). There are two females from the same locality and two from Mundi, Kangra district, W. Himalayas (3,200 ft.) (Reg. Nos.  $\frac{9636}{2}$ ,  $\frac{9638}{2}$ ).

## MYRMELEONIDÆ.

The Myrmeleonidæ of the collection sent me are a most showy and interesting lot; among them are represented a considerable proportion of the described regional forms. The list is as follows:—

*Stiphronera inclusa*, Walk.—Sikkim, E. Himalayas. One specimen.

[There is also a specimen in the collection from Upper Burma.—*N. A.*]

*Stenares improbatus*, Walk.—Bangalore, S. India (*Cameron*). One specimen.

*Palpares tigroides*, Walk.—Dalkhola, Purneah District, N. Bengal (*C. A. Paiva*). One specimen.

*Palpares contrarius*, Walk.—One in the Lefroy collection from Mussoorie, United Provinces, and one in the Museum collection from Khurda, Orissa, 23-iii-84 (*W. C. Taylor*) (Reg. No.  $\frac{41.3.2}{10}$ ).

*Palpares infimus*, Fabr.—One specimen in the Lefroy collection from Bulsar, Bombay Presidency.

*Palpares pardus*, Rbr.—A number of specimens of this handsome and very variable species in the collection of the Museum from Dehra Dun, base of W. Himalayas, October 1900, from Khurda, Orissa (*W. C. Taylor*), and from Bangalore, S. India (*Cameron*) [also from Rampur Haut, Bengal, “common in railway carriages at light,” 10-x-1907 (*Paiva*).—*N. A.*], and in the Lefroy collection from Surat, Bombay, and from Pusa, Bengal.

*Palpares* sp.?—Perhaps a variety of the preceding, in the Lefroy collection, from Pusa, Bengal

*Periclystus singularis*, West.—Two specimens in the Lefroy collection, one from Surat, Bombay, the other from Pusa, Bengal.

*Tomatares compositus*, Walk.—One fragment in the Museum collection from Cutch, W. India.

*Acanthaclisis edax*, Walk.—One specimen from Ramnad, Madura district, S. India; Aug., 1905 (*Annandale*) (Reg. No.  $\frac{94.2.3}{14}$ ).

*Acanthaclisis horridus*, Walk.—One specimen from Sibsagar, Assam.

*Acanthaclisis eustalacta*, Gerst.—One specimen from Lucknow, United Provinces (*B. Aitkin*).

*Myrmeleon marginicollis*, Gerst.—Several specimens from Kulu, W. Himalayas.

*Myrmeleon sagax*, Walk.—Several specimens from Bhim Tal, Kumaon, W. Himalayas, and Upper Assam. [Also three specimens from Kurseong, E. Himalayas.—*N. A.*]

*Myrmeleon punctulatus* (?), Rbr.—One specimen from Chatrapur, Ganjam district, Madras.

*Formicaleo verendus*, Walk.—Several specimens in the Museum collection from Kulu and one from the Kangra Valley, W. Himalayas; one in the Lefroy collection from Mussoorie, United Provinces.

*Formicaleo periculosus*, Walk.—A number of specimens in the Lefroy collection from Pusa, Bengal.



*Macronemurus nefandus*, Walk.—Three specimens in the Museum collection; two from Kulu, W. Himalayas, and one from Dehra Dun, base of W. Himalayas.

*Macronemurus infestus*, Walk.—One specimen in the Lefroy collection from Surat, Bombay, and one from Pusa, Bengal.

*Creagris sedulus*, Walk.—One specimen in the Lefroy collection from Mussoorie, United Provinces, and one from Palamow, Bengal, three in the Museum collection from Chatrapur, Ganjam district, Madras, and one from Shahzadpur, Allahabad, United Provinces.

*Myrmeleon adversus*, Walk.—Two specimens of what I take to be this species are in the Lefroy collection, one from Pusa, Bengal, and one from Bulsar, Bombay Presidency.

*Myrmecalurus acerbus*, Walk.—A number of specimens in the Museum collection from Bushire, Persian Gulf (*W. D. Cumming*); Baluchistan (*J. Cleghorn*); Seistan, Persia (*Sir A. H. McMahon*), and in the Lefroy collection from Mussoorie, W. Himalayas, United Provinces; Palamow, Bengal; Chevist, Punjab; and Pusa, Bengal.

#### CHRY SOPIDÆ.

This family is represented in the collections before me by at least a dozen species representing five genera, one of which is a new genus. Apparently but two species, *Chrysopa ignobilis*, Walk., and *Ancylopteryx candidus*, Fabr., stand in our lists to the credit of India. Nevertheless there are numerous described Oriental species in several genera, and some of them are poorly described. Therefore, I have refrained from describing any but the most strongly marked species in the collections sent for study, especially those belonging to the enormous genus *Chrysopa*.

Besides the new genus *Tumeochrysa* described below, the recently described *Eremochrysa* of Banks, hitherto known only from America, is represented in the collection by a single handsome species.

The genera of Chrysopidæ of the Indo-Australian region may be separated as follows:—

- a. Cells in the basal part of the fork of the median vein alike, the third ("third cubital cell") undivided; antennæ excessively long and slender, much longer than the fore wings; the three series of gradate veins of the fore wing not parallel.
- b. The first (innermost) series of gradate veins joins the radial sector anteriorly;

cells of the wing disc broad  
and venation open, net-like *Synthochrysa*, gen. nov.  
Type *H. stigma*, Girard.

- bb.* The first series of gradate veins parallels the radial sector for much of its length and anteriorly joins the second series; all cells of the wing disc and outer margins are narrowly transversely linear . . . . *Apochrysa*.
- aa.* Of the cells in the basal part of the main fork of the median vein the third is differentiated, appearing to be transversely or obliquely divided.
- b.* Apparently about equally divided . . . . *Nothochrysa*.
- bb.* Very unequally and obliquely divided.
- c.* Gradate veins distributed irregularly over the wing disc, not in regular series. Basal segment of the antennæ enormously enlarged . . . *Tumochrysa*.
- cc.* Cross-veins of the fore wing forming two rather regular gradate series.
- d.* Basal part of the costal space narrow, gradually widened towards the middle of the wing.
- e.* With a single gradate series in the hind wing . . . *Eremochrysa*.
- ee.* With two gradate series in the hind wing . . . *Chrysopa*.
- dd.* Costal space of the fore wing suddenly and greatly dilated *Ancylopteryx*.

*Nothochrysa robusta*, sp. nov.

A single female specimen (the type) from Sibsagar, Assam (*S. E. Peal*) (Reg. No.  $\frac{94}{2} \frac{2}{2}$ ), and a single male that I take to belong to the same species, from Darrang, western base of Daffa Hills, also in Assam (*Godwin-Austen*).

Length of female 19 mm. Antennæ 16 mm. additional. Expanse of wings 62 mm.

Colour tawny yellow, including the legs; the top of the thorax and the eyes with coppery reflections. Antennæ brownish, paler

basally. Prothorax wider than long, with the front angles broadly eroded, and the hind angles square, front and hind borders darker in colour and with a sulcate middle brown median groove.

The male is slightly smaller and the prothorax is as long as wide, and on either side of its disc are four oblique brownish dashes arranged in two pairs.

The wings of both male and female are hyaline with veins mostly yellow. The ends of all cross-veins abutting on the radial vein are blackish, this colour more intense apically, where the apex of the radial sector also is black. Gradate cross-veins black, and in the inner series the connecting veins also. There are sixteen cross-veins in the inner gradate series. The wing roots are strongly stained with brown, including also a few stout basal cross-veins.

*Nothochrysa lefroyi*, sp. nov.

A number of specimens of both sexes represented in both collections. In the Lefroy collection from Pusa, Bengal; Lyallpur, Punjab; and from the Khasi Hills, Assam (3,000—5,000 ft.). The Museum specimens are from Kulu, W. Himalayas, and Sibsagar, Assam (*S. E. Peal*) (Reg. Nos.  $\frac{6.8.2.4}{1}$  and  $\frac{5.8.7.8}{5}$ ).

Length of body 11 mm. Antennæ 14 mm. additional. Expanse of wings 38 mm.; fore wing length 18 mm., width 5 mm.; hind wing length 17 mm., width 4.5 mm.

Colour dull fulvous, with phalerate sutural markings of greenish black. Face tawny yellow, with reddish brown lines on the sutures. Antennæ black except at the base where two segments are more or less yellowish. Eyes with coppery and greenish bronze reflections. Prothorax with eroded front angles (as in the preceding species) about as wide as long (a little wider in the female), with a narrow mid-dorsal longitudinal sulcus, dull tawny yellowish in colour, with darker, diffuse triangular spots extending upwards from the sides in some of the (female) specimens. Meso- and meta-thorax tawny yellow, phalerate with greenish black on the sutures. Legs yellowish, hind ones paler. Wings hyaline, veins tawny yellow, no black on cross-veins. Stigma diffuse, rather long. Nine gradate cross-veins in the inner series.

*Nothochrysa indigena*, sp. nov.

Two specimens from Calcutta in the Museum collection, one labelled "Indian Museum premises (*R. Hodgart*)."

Length of body 13 mm. Antennæ 15 mm. Expanse of wings 38—42 mm. Fore wing of the type specimen (Reg. No.  $\frac{9.5.9.5}{7}$ ), length 18 mm., width 7 mm.; hind wing, length 17 mm., width 5.5 mm.

A yellowish fulvous species with a black dorsal band covering the second and third segments of the thorax and the fourth, fifth, and sixth segments of the abdomen, and with large and conspicuous brown stigma. Head fulvous, including the antennæ. Eyes with

coppery reflections. Wings hyaline, veins yellow. Wing-roots black, as are two cross-veins in the anal angle. The gradate cross-veins are also blackish, and a few of the cross-veins joining the radial vein and the radial sector are blackish on both their ends. Inner gradate series consists of eight or nine cross-veins.

*TUMEOCHRYSA*, gen. nov.

Allied to *Anomalochrysa* of the Hawaiian Islands, having the cross-veins of the wing disc scattered, not arranged in regular gradate series. Antennæ about as long as the body, shorter than the wings, in the male at least with huge erect tumid basal segments.

Type *T. indica*.

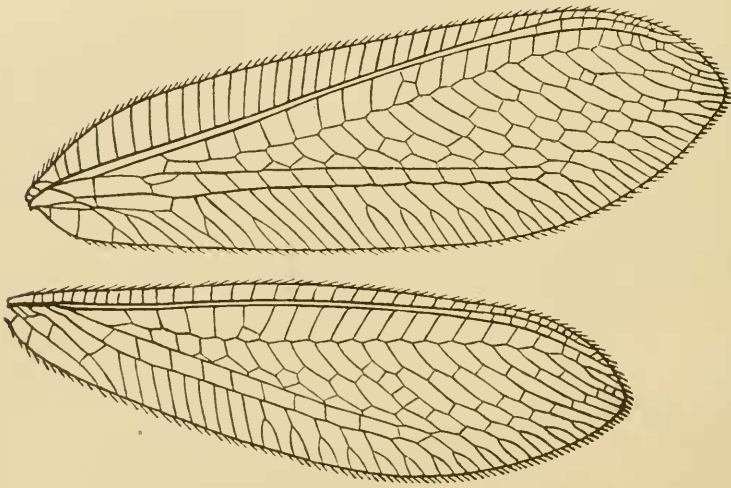


FIG. 3.—Wings of *Tumeochrysa indica*, Ndm.

*Tumeochrysa indica*, sp. nov.

One male specimen collected by Dr. Annandale at Bhim Tal, Kumaon, W. Himalayas (4,500 ft.), 19—22-ix-06 (Reg. No.  $\frac{9821}{15}$ ).

Length 15 mm. Antennæ 15 mm. Expanse of wings 45 mm.

A rather slender and elongate species, yellowish in colour (perhaps greenish in life). Face yellow. Head surmounted by the high, erect, basal antennal segments, which nearly cover its entire width, and which are closely approximated to one another. Each basal segment is yellow, swollen, sub-tuberculate on the postero-internal side, and is as long as the next twelve subequal segments succeeding it, and bears on its outer side a diffuse red line. On the disc of the head there is in the rear a similar transverse red line from eye to eye, extended forward between the basal segments of the antennæ on the median line in a diffuse triangular dilatation.



Thorax yellow beneath, somewhat darker above and tinged with reddish on the principal convex areas. Legs pale yellow, the tips of the tarsi darker. Wings hyaline with yellow veins, otherwise unmarked. Abdomen yellow beneath, somewhat darker above, and clothed with scanty yellowish pubescence. The paired lateral appendages short and scarcely forcipate. There is a median ventral appendage, three times as long as the laterals, jointed at two-thirds its length, and with the tip strongly reflexed at this joint.

*Eremochrysa marmorata*, sp. nov.

A single specimen from Upper Assam in the Museum collection (Reg. No.  $\frac{2096}{106}$ ), broken and incomplete, but striking and characteristic. I refer it tentatively to *Eremochrysa* of Banks, and with it McLachlan's New Zealand species *Chrysopa opposita*.

Length of body about 10 mm., of antennæ about 12 mm. Expanse of wings 25 mm. The coloration is wholly obscure save in the wings, which are beautifully marked, and are quite sufficient for the recognition of the species. The membrane of the wings is hyaline, and the cross-veins are all tinged with golden brown, strongly on the basal third of both wings, and all about the entire wing margins, weakly and diffusely and confluent over the wing disc. The brown on the base of the radial sector and about the stigma amounts to diffuse spots of distinctly darker colour.

*Ancylopteryx tessellatus*, sp. nov.

Four specimens in the Museum collection, two from Upper Assam (Reg. Nos.  $\frac{1275}{9}$  and  $\frac{1278}{9}$ ) and two from Sibsagar, Assam (*S. E. Peal*) (Reg. No.  $\frac{9523}{153}$ ).

Length to wing tips 15 mm., expanse of wings 28 mm. Antennæ about as long as the fore wings. Head, including antennæ, and prothorax pale yellow. Prothorax one half longer than wide, legs yellow, the tips of the tarsi somewhat darker. Wings hyaline and veins white. There are pale cloud-like brown spots at the stigma, at the hinder end of the inner gradate series of cross-veins and on the tips of the cubital vein where these reach the hind margin. And there are paler more diaphanous and more confluent clouds on three or four of the cross-veins at the rear of the stigma (at the front of the radial vein), on the base of the radial sector and on the anterior gradates, and in alternate spaces along the hind margin of the fore wing. Hind wing similarly marked, but less distinctly, only the basal spot being at all clear.

*Ancylopteryx candidus*, Fabr.—One specimen from Upper Assam (Reg. No.  $\frac{1316}{9}$ ).

HEMEROBIIDÆ.

Two indigenous genera, *Hyposmylus* and *Berotha*, and two wide-spread ones, *Hemerobius* and *Drepanopteryx*, are not represented in the collection; the genus *Osmylus* is represented by two of

its five species: *Sisyra* is represented by bred specimens of the new species discovered by Dr. Annandale in the freshwater sponges, *Spongilla carteri* and *S. alba*, and whose habits are briefly described by him in a paper on "Some animals found associated with *Spongilla carteri* in Calcutta" (*Journ. Asiatic Soc. Bengal* (N.S.), 2, pp. 187—196, 1906). And in addition to this new *Sisyra*, there are two new genera of Hemerobiidæ represented.

I think I have identified the *Hemerobius setulosus* of Walker, and it is a *Micromus*.<sup>1</sup> And since McLachlan long ago identified Walker's *Hemerobius setulosus* as a species of *Osmylus*, the typical genus *Hemerobius* appears to be without a representative in India. A second species of *Micromus* is represented by a poor feneral specimen in the Lefroy collection, which agrees in size and number of divisions of radial sector, and number of cross-veins in its gradate series with *M. australis*, Hagen, from Ceylon, and it is probably that species; colour comparison is impossible.

The two species of *Osmylus* in the collection are *O. langi*, McL., from Kulu, W. Himalayas, and Kurseong, E. Himalayas; and *O. tuberculatus*, Walker, from Upper Assam and from the valley of the Tenasserim river, Lower Burma.

The new species and genera are described below.

*Sisyra indica*, sp. nov.

(Pl. xxi, fig. 1.)

Male and female specimens, bred by Dr. Annandale from larvæ taken on *Spongilla carteri*. Bred 16th March, 1907. [Common in Calcutta.—*N. A.*]

Length to wing tips 5 mm. Expanse of wings 10 mm. Length of antennæ 3 mm. Colour brown, nearly uniform. Antennæ black. Legs pale. Disc of head and thorax clothed with sparse yellowish hairs. Prothorax wider than long. Abdomen blackish, except the apex which is somewhat paler. Wings (pl. xxi, fig. 1) smoky hyaline, with brown veins. Costal cross-veins very unequally distributed, there being about ten in the basal half and only one in the distal half of the space between the base and the stigma.

The median vein is three times dichotomously forked in the fore wing, but in the hind wing the posterior division of this vein has one forking fewer than the anterior. The ovipositor of the female is straight and stout and blunt at tip, and is about as long as the abdomen is thick. The paired lateral appendages of the abdomen in the male are stout and convex and hairy basally on the outer side, but internally they are suddenly extended in a pair of long slender claw-like processes directed inwards and crossed at their tips, these slender horny processes being longer than the basal part from which they arise.

The cocoon of this species is oval in form and 4 mm. long. It consists of fine spun pure white silk, close woven; the outer

<sup>1</sup> The specimen is from Kulu, W. Himalayas.—*N. A.*

layer is irregularly woven, with stay threads extending to all the high places in the dried sponge mass, in the hollow of which it nestles.

The larva of this species is 4.5 mm. in length, and 1 mm. in width, and its suctorial setæ are as long as the head and thorax together and somewhat longer than the setaceous antennæ. The setæ on the middle abdominal segments are rather more closely sessile than in the other larvæ of *Sisyra* hitherto described, but otherwise apparently similar. Some of the larvæ sent me by Dr. Annandale were taken by him from osteoles of *Spongilla alba*.

Dr. Annandale has sent me the following notes on the habits and ethology of this species:—

“I am now able to send you larva, pupa and adult of the common sponge *Sisyra* of Calcutta. This species is common in the canals of *Spongilla carteri*, one of our most abundant freshwater sponges in India. I have only found the larvæ between August and March, that is to say in the rains and cold weather, but the sponge as a rule dies in the hot weather. The larvæ vary from green to white in colour, and can usually be discovered clinging to the walls of the oscula and larger canals of the sponge, in which these structures are more patent than they are in most Indian species. The proboscis seems to be inserted into the substance of the cells of the host, and if the sponge is green, the contents of the stomach of the parasite are also green. If the sponge dies, and the water becomes foul, the parasite forsakes it; and I have even found a few individuals among filamentous algæ in the tanks. The mode of progression adopted, when the insect is at large, is either that of crawling slowly on a solid support or that of swimming through the water by means of movements of the abdomen. The thorax is held vertically upright, in the latter case, with the head flexed a little downwards and the abdomen strongly upward; so that the whole animal has the outline of an S when seen from the side. The abdomen is alternately approximated to and removed from the thorax with great rapidity, and these actions bring about a forward movement. I could not observe any regular movements on the part of the jointed gills, but apparently they aid in supporting the insect upright in the water.

“At the beginning of March a great number of specimens of *Spongilla carteri*, being attached to the ends of hanging branches and in similar situations, are left high and dry, as the water evaporates from the tanks. In the circumstances the larvæ, sooner or later, leave the interior of the sponge, in which they sometimes continue to live for some days after it has been left dry, and pupate in hollows on the external surface. A flimsy cocoon of white silk, covered and fixed by a loose web of the same material, is spun, and the imago emerges in about a week. The imago is very sluggish and apparently takes to flight with difficulty.”

## ANNANDALIA, gen. nov.

Mandibles strongly dentate. Palpi with the terminal segment lanceolate, attenuate to apex. Antennæ short. Wings short and broad, hairy. Subcosta and radius separate to the wing margin. Costal space wide basally, with a basal recurrent vein. Two subcosto-radial cross-veins, one basal and one near the middle of the wing. One series of gradate veins in the fore wing situate just beyond the middle of the wing, wanting in the hind wing, both wings with a very wide area of dichotomous forks.

Type, the following species :—

*Annandalia curta*, sp. nov.

(Pl. xxi, figs. 2—4.)

Two specimens from Calcutta, collected by Dr. Annandale on the 3rd August, 1906. [Single individuals of this species are not uncommonly found in Calcutta seated at night round lamps on the whitewashed walls of houses. They are very sluggish.—N. A.]

Length of body 4 mm. Length to wing tips 5 mm. Antennæ 2 mm. Expanse of wings 9 mm. Fore wings, length 4 mm., width 2 mm.; hind wings, length 3 mm., width 1.5 mm. Fore wings oblong, obtusely rounded at both ends, and oblique; hind wings obovate obtuse at outer end. Membrane of wings hyaline, strongly marked with brown in two shades, the colour being laid on in transverse concentric lines around the wing base as a centre. The veins are alternately yellow and brown, the brown occurring where the concentric lines of dark colour cross the veins. There are three darker areas in the fore wing, a blackish one on the base of the wing extending outwards to the base of the radial sector, upon which is a black tri-radiate spot; there is a second dark area, a little paler, laid across the base of the second division of the radial sector, and this is confluent at fore and hind margins of the wing with a third darker area, which encircles the wing apex covering the terminal forks of the veins. The hind wings are largely hyaline, slightly infuscated on the costal area and on area of the marginal forks. The hind wing is almost without cross-veins. The anterior branch of the cubital vein is in the fore wing dichotomously four times forked, and the median vein three times forked.

The general colour of the body is blackish brown. The head is wholly blackish. The antennæ are dull yellowish, darker at both ends. The antennæ consist of about forty remarkably uniform segments, each hardly longer than wide, only the two basal and terminal segments markedly differentiated; the basal one being four times as long as the second segment, and likewise the last segment about twice as long as the others. The labrum is semicircular, and the palpi are black in colour and lance-acuminate in form.



## PAROSMYLUS, gen. nov.

Labrum emarginate, mandibles broad and coarsely toothed. Fore coxæ (in the male at least) with a cylindric corneus internal process. Wings broad, moderately hairy, costal area narrow at base, widened beyond, and traversed by numerous partly branched cross-veins; subcosta and radius fused at tip. One basal subcostal cross-vein, the radial sector arising near it.

Gradate cross-veins hardly differentiated, the cross-veins of the disc being numerous and irregular in arrangement. Median and cubital veins each with two long closely parallel branches, suddenly terminating in the peripheral border of marginal forks, the hinder branch of the cubitus with a long dependent series of forks to the hind margin. Tarsal claws serrate basally.

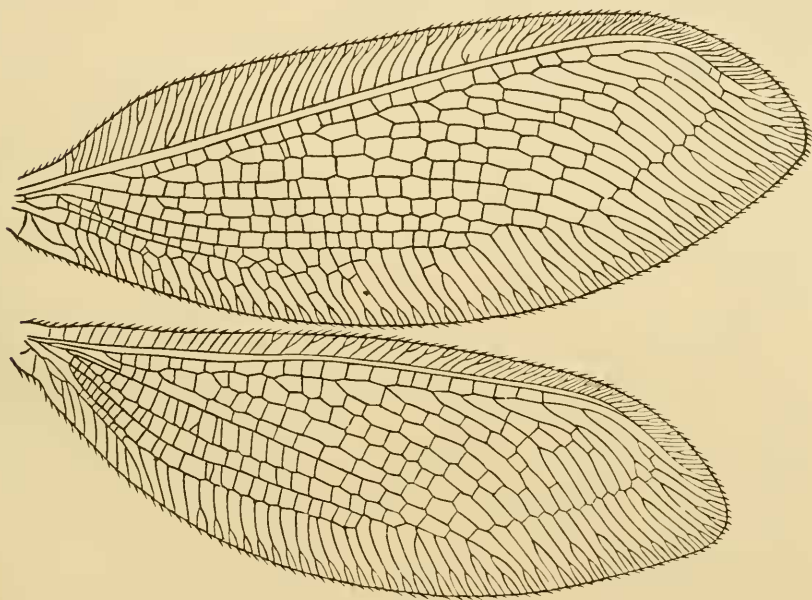


FIG. 4.—Wings of *Parosmylus prominens*, Ndm.

Type, the following species:--

*Parosmylus prominens*, sp. nov.

(Pl. xxi, figs. 5—10.)

Four specimens, male and female, from Kulu, W. Himalayas, and one from Lahoul (10,400 ft.), W. Himalayas.

Length of body 14 mm. Antennæ 10 mm. Length of fore wing 27 mm., of hind wing 26 mm.; expanse of wing 57 mm.

Colour fuscous, paler beneath and on sutures. Head with a broad convex prominence just behind the three ocelli. Antennæ short, consisting of about 56 segments, with a short stout cylindric basal segment and the third segment about twice as

long as the second or the fourth. Palpi short, their segments of nearly equal length. Legs rather stout and long; fore coxæ with the internal process shown in plate xxi, fig. 5, and all the claws basally serrate (plate xxi, fig. 9).

The wings are broad except at base, with membrane smoky hyaline and parti-coloured brownish veins. The wide costal strip is traversed by long close-set cross-veins separating between very narrow cells; and when forked, the forks are short and close to the costa. The cells of the disc are more or less hexagonal or quadrate but towards the region of the terminal forks they become very much elongated. The first forks of the radial sector and of the median vein are at about the same distance outwards from the wing base, and the sector closely parallels the main stem of the radial vein. The colour pattern of the wings is very complex, the dull brown touches being minute. There is a series of alternate lighter and darker brownish touches about the whole wing margin; four or five of these are decurrent from the front margin and traverse the yellowish stigma. There is a series of minute brownish clouds covering the cross-veins between the radius and its sector, there are three larger ones laid across the branches of the cubital vein, and there are numerous faint clouds upon the disc and on the anal angle. There is a round, more or less tuberculoid spot in the middle of the disc, fainter in the hind wing. The hind wing as a whole is paler, the disc being almost hyaline.

The genital apparatus of the male is most curious and puzzling. It is shown in lateral view in plate xxi, fig. 8. What I have been tentatively calling a sperm conveyor depends from the hindmost segment. This is boat-shaped in outline, with a pair of minute palps on the bi-lobed posterior end. It appears to be capable of being swung in and out on a more or less flexible and muscular pedicel, and when swung inwards, its point must be close to the sperm orifice. The abbreviation of the segment before it, and the prolongation of the one before that, are shown in the figure; and behind the ventral prolongation of the apex of the last mentioned segment protrude a pair of lanceolate processes of uncertain function. Observation of living specimens would be most valuable, as an aid to understanding these parts.

There is a fragment of a second species from the valley of the Tenasserim river (Reg. No.  $\frac{9.0.0.9}{4}$ ) with the male genitalia well preserved. It is obviously different (pl. xxi, figs. 11 and 12).

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